Special issue
The lesson learned:
What we have learned
from the pandemic
and how to innovate
schools and universities
in order to overcome it

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Italian parents' perception about learning practices and educational effectiveness of remote schooling during the first lockdown

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Abstract

The abrupt interruption of face-to-face educational activities imposed by the Italian Government in response to the Covid-19 emergency required a rapid switch to remote schooling to guarantee continuity in education. This paper explores the family's perception about the organization of remote schooling and its impact on learning. In particular, the authors investigated the technology used and the strategies adopted by the teachers to face the challenges posed by this rapid change in the educational paradigm through an online survey carried out between May and June 2020. More than 19,000 families answered the survey for a total of 32,000 children, highlighting a favorable evaluation from the parents. The analyses confirm that several factors linked to the technology used and instructional learning design significantly impacted the parents' evaluation.

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Introduction

The World Health Organization (WHO) in spring 2020 declared the Covid-19 epidemic an international public health emergency, so most educational institutions around the world suspended face-to-face teaching activities and moved towards remote schooling to contain the spread of the epidemic. In April 2020, as reported by UNESCO (2020), 90% of students (about 1.6 billion children) around the world found themselves in remote school.

On our national territory, the closure of school in presence, was stated by the Prime Minister Decree (DPCM) of 4 March 2020, and with subsequent measures (DPCM of 26 April, DECRETO-LEGGE 16 May 2020, n. 33, DPCM of 17 May) teaching was provided online until the end of the school year. The sudden transition from face-to-face education to remote schooling has disrupted the entire education system requiring teachers, families, and students to mobilize massive technological resources and digital, pedagogical, and relational skills in a completely unusual educational and social context.

Several variables which seem to have impacted on the management of full-time remote schooling have been identified. In particular, the socio-economic gap amongst families, the technological equipment for some of them, the inadequate technological competences of all the actors involved, the lack of effectiveness by teachers in rethinking their practices mediated and supported by technology and the presence of students with SEN (Special Educational Needs) can be considered among the main critical factors, present before the pandemic.

The transition to remote schooling has emphasized the even more decisive and strategic role of the family in the education of their children. The school as an educational system certainly has the family as its privileged point of reference, with which it shares the task of promoting the harmonious growth of children and adolescents. In any

case, despite the communion of intentions, the school and the families pursue different educational objectives with specific and distinct rules, methods, and places.

Remote schooling, by crossing the family threshold, has cleared the boundaries between the two educational agencies and questioned rules and actions that guaranteed them an identity and a clear role, albeit in mutual respect and commitment. Families belonging to low and medium socio-cultural classes seem to have been the most penalized for the lack of adequate domestic spaces and skills to support their children during ordinary online learning activities (Benigno et al., 2021; Di Pietro et al., 2020). Furthermore, they seem to be the most penalized for the lack of technologies: according to recent ISTAT data (2020) 33.8% of Italian families do not have a computer or tablet at home. In the research reported by CENSIS (2020), 84.2% of the interviewed principals state that it has been necessary to provide hardware equipment to students, while Benigno et al., (2021) have found 97.53% of families declared themselves technologically ready to start remote schooling.

The critical issues and reflections related to technologies have also led to a wider use of technologies for educational purposes than before.

Despite significant investments made over the years to integrate digital technologies into teaching and learning processes (Bingimals, 2009; Buabeng-Andoh, 2012; Gil-Flores, Rodríguez-Santero, & Torres-Gordillo, 2017), the lack of ICT integration in teachers' daily routine is well known. In the literature this is related to both external and internal factors, even referred to as interpersonal intrapersonal factors. In particular, the competences in the use of technologies represent a critical variable that influences the integration in the didactic activity. Furthermore, resistance to ICTs related changes, the ineffectiveness of teacher training, the lack of time to adopt ICTs in daily class activities, and the lack of technical staff who can support the teachers are variables associated with a scarce ICTs integration in educational practices (European Commission, 2019). However, if the situation related to the emergency forced the teachers to update their digital competences, several studies found that most of the teachers have replicated online the lecture they used to have face-to-face.

Even the students at the start of the pandemic were not very skilled in the use of technologies. Benigno and colleagues (2021) reported how all students, from childhood to high school attendees, needed parental support for the management of technological equipment during remote schooling, confirming the data from ISTAT research (2020) showing that only 30% of young people between 14 and 17 have high digital skills. Although the use of technologies and mobile tools by "digital natives" (Prensky, 2001) is continuous, sometimes inducing forms of technological dependence, it does not however translate into the ability to use it (Fraillon et al., 2019).

Despite all the difficulties that emerged, there is evidence that the school and families, even if not in a homogeneous way, were able to reorganize the remote schooling in a short time, thus promptly responding to one of the most dramatic changes caused by the pandemic (Benigno et al., 2021; Broom et al., 2020; CENSIS, 2020).

In the context of this paper, we explore the perception of families regarding the organization and management of remote schooling and how students were involved. Moreover, we investigate the efficacy of remote schooling on students' learning and the impact of factors like prior technologies experience, the tools and the educational practices used during the emergency, on parents' perceptions.

Method

Participants

19,527 families participated in a survey aimed at gathering data on the management of remote schooling during the first lockdown. One adult member of the family was asked to fill an online questionnaire, and the responding person was generally the mother (86.7%). The survey asked parents to provide data for each school-age child in the family in order to obtain a detailed picture of the impact of distance learning on the families. The total number of pupil records collected amounted to 31,805. By taking into account the total number of parents (both the respondent and the other parent in the family), 30.8% of them are between 45 and 49

years old; 94.4% of them are Italian citizens. About the level of education, 36.5% of parents have a university degree, and 46.2% have a secondary school diploma. In terms of employment status, 77.2% of parents are employed, and 10.6% unemployed. Data reveals that 55.3% of the surveyed parents worked from home during the lockdown period. The sampled families reside prevalently in the regions of Central Italy (68.9%). Specifically, to the sample of children, it includes pupils in nursery school (10.2%), first cycle primary (16.6%), second cycle primary (23.3%), first cycle secondary (25.5%) and second cycle secondary (24.5%).

Respondents reported 905 cases of children with special educational needs, attending the following school levels: 11.2% preschool, 21.7% first-cycle elementary school, 20.3% second-cycle elementary school, 26.3% first cycle secondary school, and 20.6% second cycle.

Instrument

The questionnaire developed during the first phase of the Covid-19 emergency (March-May 2020) was designed to investigate the impact of remote schooling in the family context. It contains 58 questions, some of which are closed-ended, and others in a Likert form graded differently depending on the type of evaluation required, divided in three different sections.

The first section is related to the socio-demographic profile of the family. In particular, the data of the parent filling in the questionnaire and of the other parent was collected (gender, age, nationality, citizenship, school level, employment status, parents in remote working).

The second section provides a picture of families' technological endowment, their initial capacity to respond to distance learning and parents' remote working requirements, and the level of confidence of the families' members with the technological resources adopted in the online educational sessions. The aim of this section was to understand the conditions in which the families found themselves when the online lessons were activated.

The third part of the questionnaire, replicable for each child in the family, was structured in several sub-sections: one relating to

the educational organization, aimed at investigating the use of the distance education before the Covid-19 emergency and the organizational and methodological aspects of distance learning during the lock-down phase; another included a series of questions aimed at understanding the impact of the distance education on the family, in particular on the organization of the daily management of family routines and on the remodeling of common spaces. A last subsection aimed at investigating the emotional-affective and behavioral aspects of students during the lock-down. Finally, respondents were asked to describe the remote schooling by specifying adjectives in an open-ended question. After the initial design, the questionnaire was tested with a small group of families, then administered online through the open-source software "LimeSurvey" and spread through the snowball sampling technique between May 12 and June 22, 2020.

Data analysis

The data analysis was conducted by selecting from the questionnaire those items that could provide a detailed insight into aspects of the organization of remote learning, the technologies and pedagogical practices used, and prior experience. In the following subsections, we report the descriptive analysis of these dimensions.

The data analysis concludes with the presentation of a regression model, developed using the technique of linear mixed models, which aims to investigate whether these dimensions have influenced parents' perceptions of the effectiveness of remote learning.

Experience in the use of educational technology before the Covid-19 emergency

One of the key aspects we wanted to investigate was the capacity of schools to deal with educational technologies before the Covid-19 emergency.

To this end, we selected the following questions from the questionnaire:

Q1) Before the Covid emergency, did teachers use technology? (Yes/No)

Q2) Please indicate what tools they were using (Computer/ Digital whiteboard/ Electronic registry/ Messaging systems/ Online learning platform/Tablet)

Q3) Before the Covid emergency, did teachers propose remote learning activities? (Yes/No)

Regarding question Q1, parents report relatively low use of technology before the emergency (55.01%). Figure 1 shows this data by school level, highlighting more significant inexperience, especially for the lower school levels.
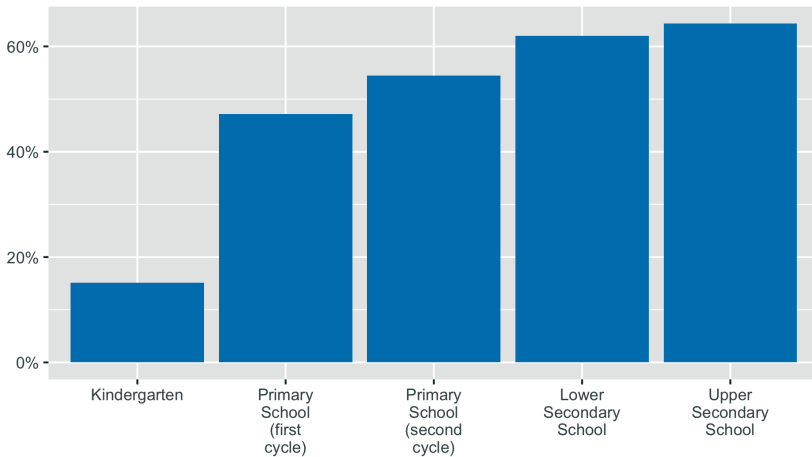
Figure 1. Technology Use before Covid-19 emergency

Figure 2 shows the answers to question Q2 by school level. Significant is the rare use in the pre-Covid period of tools such as computers and tablets that have naturally become fundamental during the emergency. In particular, the use of computers in the classroom is reported by 12.00% and 18.09% of cases in the first two cycles of primary school, respectively. The percentages fall to 3.01% and 5.23% when considering the use of tablets at the same school levels.
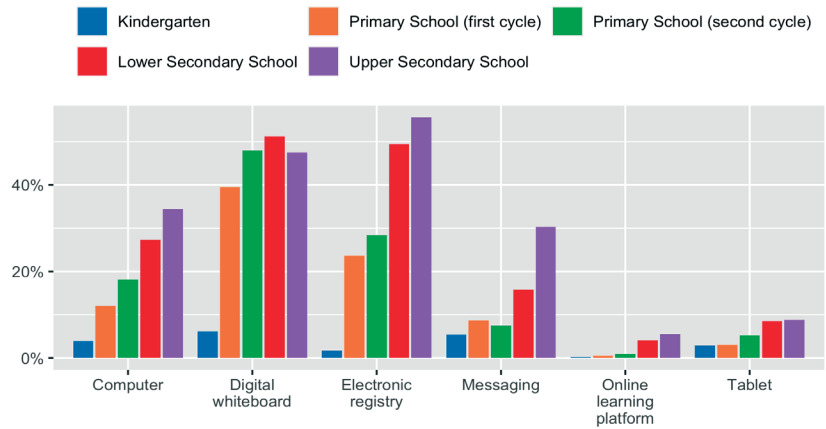
Figure 2. Tools used before the Covid-19 emergency

The results to question Q3, illustrated in Table 1, show very low percentages of remote learning use before the emergency, ranging from a minimum of 2.40% for the first cycle of primary school to a maximum of 9.13% reached by high schools.

Table 1. Use of remote learning before Covid-19 emergency

	No	Yes
Kindergarten	1881 (97.16%)	55 (2.84%)
Primary School (first cycle)	4025 (97.60%)	99 (2.40%)
Primary School (second cycle)	5690 (97.20%)	164 (2.80%)
Lower Secondary School	6315 (92.51%)	511 (7.49%)
Upper Secondary School	6200 (90.87%)	623 (9.13%)

Educational technology during the Covid-19 emergency

In order to investigate the use of technology during the emergency, we selected the following items from the questionnaire:

Q4) Do teachers of different disciplines use the same video tools? (Yes/No)

Q5) What tools and methods are teachers using to manage remote learning activities? (Video conference system/ Electronic registry/ Online learning platform/ Messaging system/ Shared folders/ Publisher Learning Resources)

Regarding question Q4, 73.6% of parents stated that teachers used the same video technologies. The analysis by school level reveals that a homogeneous approach was used, especially for primary schools, where the percentages rise to 83.34% for the first cycle and 82.35% for the second cycle.

For the secondary schools, this percentage drops to 72.01% for lower secondary schools and 61.89% for the upper secondary schools, indicating, in this case, more diversified use of video tools.

Figure 3 shows the technologies used during the emergency for each school level. Video conferencing systems appear to be widely used, along with the electronic logbook. The use of e-learning platforms is most prevalent in lower secondary schools (58.94%) and upper secondary schools (60.47%).
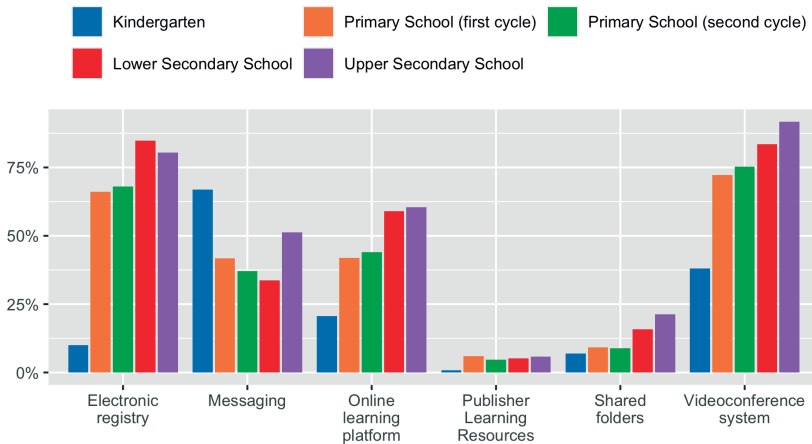
Figure 3. Tools used during the Covid-19 emergency

In order to explore the practices implemented by the school system during the first lockdown of the emergency, we analyzed the technological tools by means of the *Frequent itemsets* technique. According to (Agrawal et al., 1996), *Frequent itemsets* is a classic data mining task to discover association rules. The best-known family of algorithms that have been used to tackle this task is the a-priori algorithms that attempt to extract frequent patterns by reading data organized in multiple steps and finding candidate item sets.

The lower triangular portion of Table 2 shows absolute co-occurrences among the technologies used; in the upper triangular part, Table 2 shows the lift values among each pair of technologies.

The lift measure is the factor by which the co-occurrence of two options exceeds the expected probability of co-occurrence of the two options, had they been independent. A higher lift indicates a higher likelihood that the two options would occur together.

E-learning platforms were used as the prevalent tool in 13.67% of cases, and mainly in the intermediate band formed by the second cycle of primary school (29.45%) and lower secondary school (28.14%). Finally, only 7.76% of cases did not use videoconferencing systems either platform. In these cases, the most used tools were messaging systems and the electronic logbook.

Table 2. Co-occurrence and lift values of technology used

Video Conference Systems	Electronic logbook	Online learning platform	Messaging Systems	Shared folders	Publisher Learning Resources
20,077	(1.071)	(0.927)	(1.040)	(1.129)	(1.126)
15,304	18,192	(1.055)	(1.058)	(1.192)	(1.239)
9,360	9,652	12,861	(0.956)	(1.158)	(1.281)
8,972	8,267	5,280	10,980	(1.259)	(1.297)
3,156	3,020	2,074	1,925	3,559	(1.297)
1,136	1,133	828	716	443	1,285

Educational practices during the Covid-19 emergency

To investigate the educational practices exploited during the emergency, we selected the following items from the questionnaire:

Q6) To carry out teaching activities, the teachers use (Video conference/ Audio-video resources/ Digital quiz/ Printed questionnaires/ Shared screen/ Shared whiteboard)

Q7) In this phase, do the teachers propose collaborative learning activities? (i.e., group activities, project works) (Yes/No)

Figure 4 shows the percentages of implementation of the different educational activities according to the school level. These percentages are reported in Table 3.

Higher school levels seem to prefer synchronous activities while, on the contrary, lower classes seem to prefer asynchronous activities.
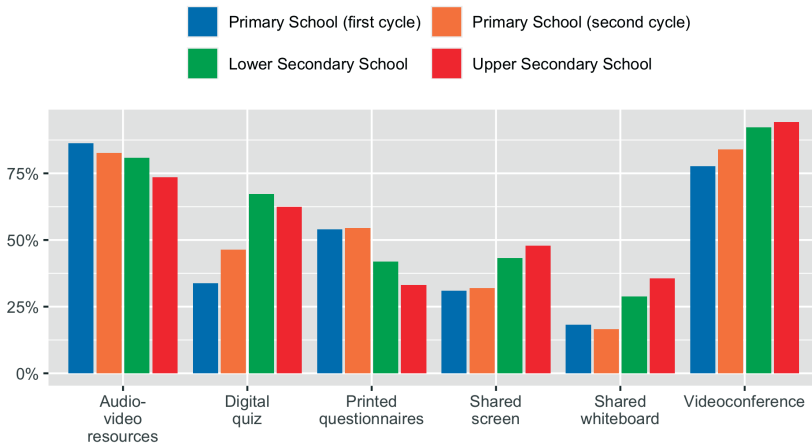
Figure 4. Educational activities carried out during the Covid-19 emergency by school level

Table 3. Frequencies of educational activities carried out during the Covid-19 emergency by school level

	Primary School (first cycle)	Primary School (second cycle)	Lower Secondary School	Upper Secondary School
Audio-video resources	86.30%	82.66%	80.82%	73.53%
Digital quiz	33.78%	46.33%	67.33%	62.39%
Printed questionnaires	54.00%	54.53%	41.93%	33.08%
Shared screen	31.04%	31.93%	43.26%	47.88%
Shared whiteboard	18.16%	16.64%	28.82%	35.60%
Video Conference	77.74%	83.99%	92.28%	94.18%

Table 4 shows the percentage of collaborative activities implemented across school levels. While for upper secondary schools and lower secondary schools the collaborative activities were implemented in 50.4% and 46.95% respectively, much lower percentages were achieved by the first cycle (20.68%) and the second cycle (28.24%) of primary schools.

Table 4. Collaborative educational activities during the Covid-19 emergency

	No	Yes
Primary School (first cycle)	3271 (79.32%)	853 (20.68%)
Primary School (second cycle)	4201 (71.76%)	1653 (28.24%)
Lower Secondary School	3621 (53.05%)	3205 (46.95%)
Upper Secondary School	3383 (49.58%)	3440 (50.42%)

As in the case of educational tools, we also performed *Frequent itemsets* analysis for learning activities. As in Table 2, Table 5 shows the co-occurrences in the lower triangular part and lift values in the upper triangular part. Again, lift values highlight two different patterns: the first one brings together the cases in which video conferencing, screen, and virtual whiteboard sharing have been used, and that we could synthetically define the synchronous pattern; the sec-

ond pattern, called asynchronous, highlights the use of audio-video resources and printed questionnaires.

Table 5. Co-occurrence of educational practice used.

Videoconference	Audio-video resources	Digital quiz	Printed questionnaires	Shared screen	Shared whiteboard
20,848	(0.995)	(1.035)	(0.991)	(1.055)	(1.059)
16,624	18,932	(1.100)	(1.111)	(1.081)	(1.080)
11,830	11,420	12,958	(1.131)	(1.221)	(1.293)
9,215	9,378	6,537	10,538	(1.084)	(1.085)
8,725	8,113	6,274	4,530	9,369	(1.593)
5,719	5,297	4,338	2,961	3,866	6,119

Evaluation of remote learning by parents

The answers to the following question represent the central element of analysis in this study.

Q8) In your opinion, what learning consequences have the lessons in remote learning had?

The results are on a numerical scale from 0 to 10, where 10 indicates a very favorable opinion and 0 a very negative one.

Figure 5 shows the quasi-normal distribution of values, with a peak value between 6 and 7; however, the overall average is relatively low (M=5.37, SD=2.75) because it is affected by the largely negative responses given by parents in many cases (10.6%). Figure 6 shows parents' ratings by their children's school level.

We fitted a linear mixed model to predict parents' evaluation of the efficacy of remote learning with respect to the variables analyzed in the previous sections.

The model includes the *family_id* as a random effect, and it was estimated using REML and nloptwrap optimizer. The model's total explanatory power is substantial (conditional R^2 = 0.68) and the part related to the fixed effects alone (marginal R^2) is of 0.11. The model's
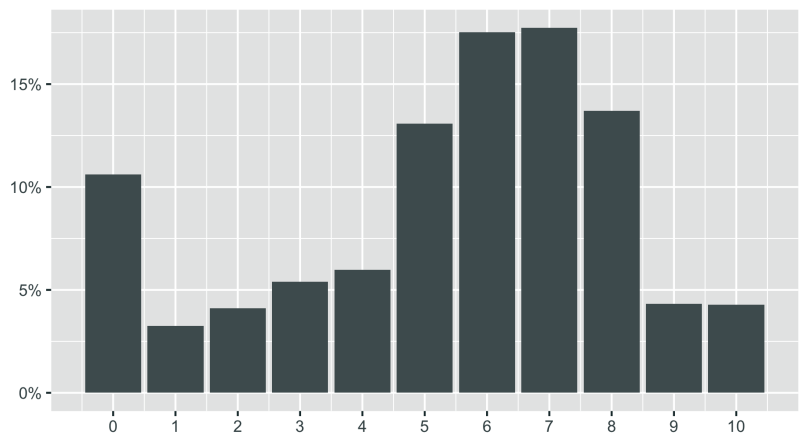
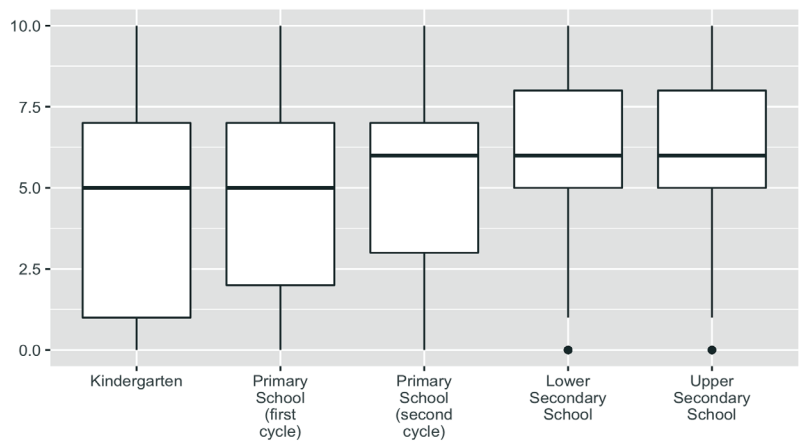**Figure 5.** Parents' evaluations of remote learning efficacy

Figure 6. Parents' evaluations of remote learning efficacy by school level

intercept, corresponding to the primary school (first cycle), no use of technology before Covid, no use of remote learning before Covid, no use of video conference systems or online learning platforms during the emergency, different video conference systems used by teachers, no asynchronous learning activities, no synchronous learning activities and no collaborative activities (β= 3.00, 95% CI [2.82, 3.17], t(22951) = 33.12, $p < .001$). Table 6 shows the fits of the model.

The effects of previous experience in the use of technology (β = 0.64, $p < .001$) and remote learning (beta = 0.35, $p < .001$) are both significantly positive.

Significant effects are also shown with respect to the use of the same video technologies by teachers (β = 0.64, $p < .001$), both for synchronous (β = 0.52, $p < .001$) and asynchronous activities (β = 0.10, $p < .05$). Finally, the effect of collaborative learning activities is significantly positive (β = 0.74, $p < .001$).

For the school level and instrument variables, we conducted a post hoc analysis (using the Tukey method). The marginal effects are shown in Figures 7 and 8, respectively.

For school level, there is a significant difference between secondary and primary school levels. Regarding tools, video conferencing systems and online platforms have a significant effect compared to other tools. The combined use of both technologies shows a difference compared to the use of a single technology.

Related to the open-ended question to describe the remote schooling with several adjectives, families have responded with different terms, some of which are more frequent. Figure 9 graphically represents the frequency analysis of the terms extracted from the parental response.

Furthermore, many families have indicated the reason for the adjectives identified. Families considered distance learning "*difficult for us parents because unfortunately we had to completely replace the teachers; demanding, given the heavy load of assigned tasks and multiple oral and written checks, in the face of explanations that in some cases do not exist*".

However, due to the difficulties highlighted, parents perceive the potential of remote schooling, also defining it as: "*heavy but certainly*

Table 6. Fits of the linear mixed model.

Predictors	Estimates	CI	p
(Intercept)	3.00	2.82 – 3.17	**<0.001**
Primary school (second cycle)	0.14	0.05 – 0.22	**0.002**
Lower secondary School	0.62	0.53 – 0.71	**<0.001**
Upper secondary School	0.74	0.64 – 0.83	**<0.001**
Use of technology before Covid	0.64	0.57 – 0.70	**<0.001**
Use of remote learning before Covid	0.35	0.23 – 0.48	**<0.001**
Tools: Only Video Conference systems	0.53	0.38 – 0.68	**<0.001**
Tools: Only Online learning platforms	0.42	0.25 – 0.59	**<0.001**
Tools: Both Video Conference and and Online learning platforms	0.73	0.57 – 0.89	**<0.001**
Teachers same Video Technology	0.64	0.57 – 0.71	**<0.001**
Synchronous learning activities	0.52	0.46 – 0.59	**<0.001**
Asynchronous learning activities	0.10	0.01 – 0.18	**0.029**
Collaborative learning activities	0.74	0.68 – 0.80	**<0.001**
Random Effects			
σ^2	2.25		
$\tau_{00\ id}$	4.06		
ICC	0.64		
N_{id}	16189		
Observations	22966		
Marginal R^2 / Conditional R^2	0.110 / 0.682		
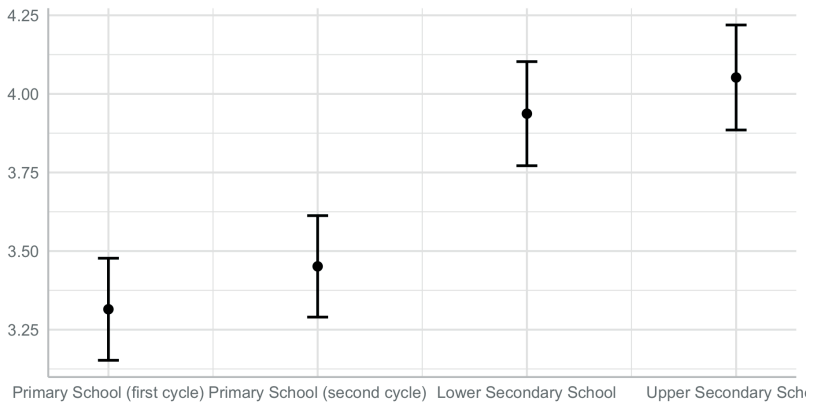
Figure 7. Marginal effects of student school level on parents' evaluations
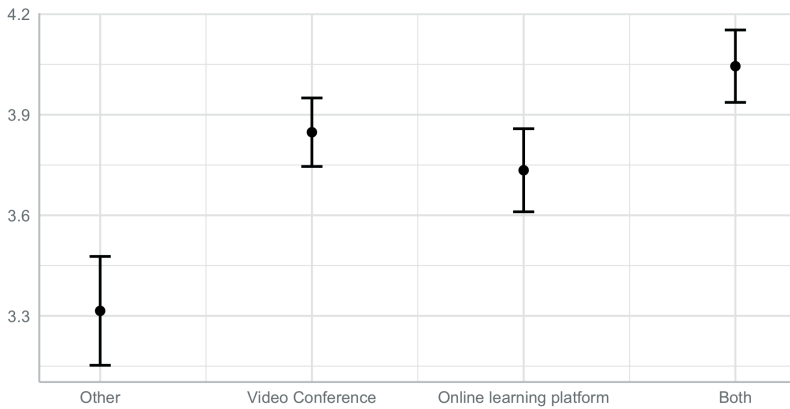
Figure 8. Marginal effects of tools use practice on parents' evaluations

constructive both for new ways of relating and learning; Fun stimulant useful in the future as it teaches to use technology in real context".

Figure 9. Words cloud generated by parents' comments

Conclusion

The present study highlights a series of results relating to the impact that the Covid-19 emergency phase has had on the Italian educational context. The families' perception of the management of remote schooling is particularly relevant because they have played an active role in educating their children during the lock-down.

As far as the use of technologies before the pandemic is concerned, the families declared that the most used tools were the Digital Whiteboard (almost 50% of cases for all school levels) and the electronic logbook, whose percentages decrease significantly in primary school, down to very low percentages when they report the experiences of distance learning. These data once again highlight the low

impact of economic investments on digitization in the Italian context (Mangione et al. 2015) and of the various training plans implemented, not least the PNSD (MIUR, 2015). These data confirm that a good part of Italian teachers did not have a consolidated experience to face the new educational challenges required by remote schooling.

Although the picture outlined is not positive as reported by Benigno et al. (2021), about 80% of families declare that remote schooling has been activated in such a way to guarantee and maintain didactic continuity.

The way in which the technological resources have been used shows a difference between the different school levels. Primary school seems to have adopted the use of the same video-communication system in a homogeneous way, while the teachers of lower and upper secondary schools seem to have acted in a more individual way. This would be in line with a long tradition of our school system where primary school teachers are more oriented towards collaboration and shared management.

Although the combined use of videoconferencing systems and e-learning platforms is frequent, the *Frequent itemsets* analysis (Table 2) shows that the two options establish different use patterns. When used together, they provide a significant gain on the remote learning efficacy perceived by the parents (Fig. 8).

Concerning teaching practices, the teachers seem to have replicated online the lecture they used to have face-to-face, as reported by other studies (Carretero et al. 2021). The collaborative strategies are mainly used, with a frequency of about 50%, by teachers of lower and upper secondary schools. This data can be easily explained in relation to the effort that primary school teachers have had in managing remote schooling. In addition, designing collaborative teaching strategies is more complex and requires high self-regulatory skills and technological competence on the part of the students, and the latter, as reported by ISTAT research (2020), are not so high.

The data on the effectiveness of remote learning as perceived by parents shows a significant percentage of parents (about 10.6%) who give an extremely negative judgment. However, the majority of parents returns a favorable evaluation.

Several factors had a significant impact on the parents' evaluation. As shown by the analysis of the marginal effects of school-level (Fig. 7), for the higher levels, the judgment is significantly better than for the lower classes. When the schools proposed an integrated offer, the parents' evaluation was considerably better. This positive effect was especially true in those cases where the predominant approach of synchronous lessons was associated with asynchronous activities, preferably collaborative.

There are several considerations that emerge from this study. Firstly, schools and families, albeit in difficulty and with different roles, have proved resilient, guaranteeing children the right to education.

Secondly, network technologies have shown their educational and social potential and the need for their use foster the teachers to overcome unimaginable obstacles before the pandemic (Buabeng-Andoh, 2012; Gil-Flores, Rodríguez-Santero and Torres-Gordillo, 2017).

Finally, it emerges that the Italian school pursues a predominantly lecture model, and technologies have been simply adapted to educational traditional practices rather than promoting didactic innovation. We can hypothesize and hope for a paradoxical effect in the future: the technologies used and consolidated for remote education can act as a driving force towards innovative teaching processes, in particular by encouraging a more active participation of students.

An investment in digital training is necessary in order to support teachers in digital pedagogy, not only for the improvement of their digital skills but to further increase their skills in teaching strategies, in managing relationships.

The analyses confirm that an appropriate instructional learning design is fundamental to obtain good results in the presence and even more at a distance, where both students and the parents should be fully aware of the path that is being followed.

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